

REMARKS

The Final Office Action mailed March 8, 2005, has been received and reviewed. As of the March 8, 2005 Office Action, Claims 1-3, 5-41 and 44-45 were pending in the application and presently stand rejected. Applicants have amended Claims 1, 21-23, 24-25, 27-28, 30-34, 36-37 and 44 and canceled Claims 39-41. As of this AFTER FINAL AMENDMENT AND RESPONSE, Claims 1-3, 5-38 and 44-45 are believed to be in condition for allowance and Applicants respectfully request reconsideration of the application as amended herein.

35 U.S.C. § 103(a) Obviousness Rejections

M.P.E.P. 706.02(i) sets forth the standard for a § 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991).

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al.

Claims 1-3, 5-7, 15-16, 19 and 44-45 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al.

Applicants have amended Claim 1, to further define the environment of the invention as recited in the preamble. More specifically, the preamble of currently amended Claim 1 now recites "A thermionic emission device", added limitation underlined. This added limitation distinguishes over field emission devices of the prior art which operate on different physical principles. Applicants have additionally amended Claim 1, to further define the grid and grid support structure. More specifically, currently amended Claim 1 recites "an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support

configured to be free standing and not supporting the anode", added limitations underlined. Support for this amendment may be found in the specification as-filed, particularly drawing FIGS. 1-2. Wall-shaped supports, as shown in FIGS. 1-2, have vertical and depth dimensions that exceed horizontal thickness, i.e., y and z-axis dimension versus x-axis, as viewed in FIGS. 3A-D. As shown in FIGS. 1-2, the wall-shaped supports extend perpendicularly from the substrate and do not form a structural support for the anode.

Sadwick et al. does not disclose elongated grid structures or free standing, wall-shaped supports for its grid. Additionally, the structural support for the Sadwick et al. grid integrally supports the Sadwick et al. anode. Because Sadwick et al. does not teach or suggest all the limitations of Claim 1, it fails the third prong of the *prima facie* case of obviousness. For these reasons, Applicants believe currently amended Claim 1 is not obvious in view of Sadwick et al. Claims 2-3, 5-7, 15-16 and 19 depend from currently amended Claim 1. For this reason, they too are believed to be nonobvious over Sadwick et al.

Regarding Claim 44, Applicants have amended Claim 44 to further define the environment of the invention as recited in the preamble. More specifically, the preamble of currently amended Claim 44 now recites "A thermionic emission device", added limitation underlined. This added limitation distinguishes over field emission devices of the prior art which operate on different physical principles that are generally not applicable or relevant to thermionic emission devices. Applicant has additionally amended Claim 44 to further define the grid means support structure. More specifically, currently amended Claim 44 recites "an elongated grid means supported by at least one elongated wall-shaped support extending perpendicularly from the substrate means, the wall-shaped support configured to be free standing and not supporting the anode means", added limitations underlined. Support for this amendment may be found in the specification as-filed, particularly drawing FIGS. 1-2.

As noted above, Sadwick et al. does not disclose free standing, wall-shaped supports for its grid. Additionally, the structural support for the Sadwick et al. grid

integrally supports the Sadwick et al. anode. Because Sadwick et al. does not teach or suggest all the claim limitations, it fails the third prong of the *prima facie* case of obviousness. For these reasons, Applicants believe currently amended Claim 44 is not obvious in view of Sadwick et al. As Claim 45 depends from currently amended Claim 44, it too is believed to be nonobvious over Sadwick et al.

In light of the above arguments and amendments to Claims 1 and 44, Applicants believe that Claims 1-3, 5-7, 15-16, 19 and 44-45 are now nonobvious in view of Sadwick et al. and Applicants respectfully request reconsideration of the obviousness rejection based on Sadwick et al.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 6,091,189 to Shinjo et al.

Claims 8-9 and 12-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Shinjo et al.

Shinjo et al. discloses a cathode for an electron tube suitable for use in a cathode ray tube. The Shinjo et al. device is not a solid state thermionic device such as the devices disclosed in Sadwick et al. and in the claims of the present invention. The diagrams of the Shinjo et al. cathode do not show any grid structure. However, the Shinjo et al. cathode may be incorporated into a conventional cathode ray tube (CRT) electron gun with grid structures having grids with holes of 0.4 mm in diameter. A conventional CRT electron gun of the Shinjo et al. variety has no direct bearing on the present invention and cannot be physically incorporated into the devices of the present invention. Finally, it does not appear that Shinjo et al. discloses “a grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode”, as recited in currently amended Claim 1, added limitations underlined.

Claims 8-9 and 12-13 all depend directly from currently amended Claim 1. Neither Sadwick et al. nor Shinjo et al. appears to disclose “an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the

substrate, the wall-shaped support configured to be free standing and not supporting the anode", as recited in currently amended Claim 1, added limitations underlined. Thus, Claims 8-9 and 12-13 are also believed to be nonobvious over the asserted combination of Sadwick et al. in view of Shinjo et al. for failing to meet the third prong of the test for obviousness stated above. Applicants respectfully request reconsideration of the obviousness rejection of Claims 8-9 and 12-13 for this reason.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 6,184,610 to Shibata et al.

Claims 10 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Shibata et al.

Shibata et al. discloses surface conduction, electron-emitting devices which are a type of field emission device that uses high electric fields to tunnel electrons between extremely close spaced electrodes and is not a thermionic emission device as recited in the claims of the present invention. Shibata et al. also discloses grids 302 arranged in a ladder-like structure for display panels. [Col. 25, Lines 49-54; FIG. 14.] However, the Shibata et al. grids 302 operate on a different physical principle which is to attract the electrons that surface emit and conduct them to the anode. This principle of operation is fundamentally different and distinct from the principles of operation and of the present invention. Furthermore, Shibata et al. does not appear to disclose "an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode", as recited in currently amended Claim 1, added limitations underlined.

Claims 10 and 11 both depend directly from amended Claim 1. Neither Sadwick et al. nor Shibata et al. appears to disclose "an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode", as recited in currently amended Claim 1, added limitations underlined. Thus, Claims 10 and 11 are believed to be nonobvious over the asserted combination of Sadwick et al. in view of

Shibata et al. for failing to meet the third prong of the test for obviousness stated above. Applicants respectfully request reconsideration of the obviousness rejection of Claims 10 and 11 for this reason.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 6,051,923 to Pong

Claim 14 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick in view of Pong.

Pong discloses a miniature electron emitter and related vacuum electronic devices. The vacuum electronic device of Pong, may include a metal grid 70 disposed between the electron emitting plate 51 and the face plate 80 so as to accelerate the electrons. [Col. 4, Lines 4-6; FIG. 3.] The grid structures of the present invention are not used to accelerate electrons, but, rather to repel and modulate the current between the cathode and anode. In addition, the grid 70 disclosed in Pong does not appear to disclose “an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode”, as recited in currently amended Claim 1, added limitations underlined. In fact, Pong is silent with regard to the structure and manufacture of grid 70.

Claim 14 depends directly from amended Claim 1. Neither Sadwick et al. nor Pong appears to disclose “an elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode”, as recited in currently amended Claim 1, added limitations underlined. Thus, Claim 14 is also believed to be nonobvious over the asserted combination of Sadwick et al. and Pong for failing to meet the third prong of the test for obviousness stated above. Applicants respectfully request reconsideration of the obviousness rejection of Claim 14 for this reason.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 5,973,444 to Xu et al.

Claims 17 and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Xu et al.

Xu et al. discloses carbon fiber-based field emission devices. The embodiments of the present invention are thermionic emission devices which work under different physical principles. Field emission devices, such as Xu et al., are cold cathode devices. During operation of a field emission device, the gate must be biased positively with respect to the electron emitter cathode base conductor in order to cause electron field emission from the cold cathode. In field emission displays, the electrons are accelerated to the luminescent material layer and collector electrode which is typically biased from a few hundred volts to several kilovolts. Without the gate electrode in close proximity and positively biased relative to the cathode to create extremely high electric fields, there would be no flow of electrons in a field emission device. [Col. 18, Lines 42-63; FIG. 10.]

Conversely, there is always a surface population of electrons in a thermionic device that has been heated. Electrons will flow from the cathode to the anode without the presence of a positive bias on the grid electrode relative to the cathode. The grid electrode is used to shut off the flow of electrons or to modulate that flow of electrons. The grid electrode need not be in close proximity to the cathode for operation. The physical structure and design, thickness, shape and materials used are very different for thermionic emission devices of the present invention relative to field emission devices. Thus, there is no reasonable expectation of obtaining a functional device if one were to combine the field emission device of Xu et al. with the thermionic emission device of Sadwick et al.

Regarding Claims 17 and 18, Xu et al. does not disclose a thermionic emission device. Applicant can find no suggestion in Xu et al. or in Sadwick et al. to combine the field emission device structures of Xu et al. with the thermionic device structure taught by Sadwick et al. There is no reasonable expectation of success should one attempt to do so. Thus, the asserted combination of Sadwick et al. in view of Xu et al. fails the first and

second prong of a *prima facie* case of obviousness with respect to Claims 17 and 18. Furthermore, regarding Claim 17, Xu et al. fails to disclose a grid comprising "carbon-containing material". Rather, as note by the Examiner, Xu et al. only teaches the use of gate electrodes formed of "W, Mo, Al, Cr, Pt, Au, Ag, Cu, polysilicon, silicides and mixtures thereof." [Col. 10, Lines 23-25.] Furthermore, the thickness of field emission gates/grids is typically in the range of Angstroms or nanometers. This range of thickness is not suitable for freestanding, the self-supporting grids of the present invention. Thus, the asserted combination of Sadwick et al. in view of Xu et al. also fails the third prong of a *prima facie* case of obviousness with respect to Claim 17.

Applicants respectfully request reconsideration of the obviousness rejection of Claims 17 and 18 based on the combination of Sadwick et al. in view of Xu et al. for these reasons.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 5,397,957 to Zimmerman

Claims 20 and 39-41 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Zimmerman. Applicants have canceled Claims 39-41

Zimmerman discloses a process and structure for an integrated vacuum microelectronic device. Zimmerman appears to disclose triode and even pentode devices having multiple grid layers 17, 94, 96. [Col. 14, Lines 18-35; FIG. 10.] However, Zimmerman fails to disclose "a grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode", as recited in currently amended Claim 1, added limitations underlined.

Additionally, the vacuum microelectronic device of Zimmerman is of the field emission variety (like Xu et al. and Shibata et al.) and is not based on thermionic emission. Applicants can find no suggestion in Zimmerman or in Sadwick et al. to combine the field emission device structures of Zimmerman with the thermionic device

structure taught by Sadwick et al. There is no reasonable expectation of success should one attempt to do so because the device physics are radically different. Thus, the asserted combination of Sadwick et al. in view of Zimmerman fails the first and second prongs of a *prima facie* case of obviousness with respect to Claim 20.

Claim 20 depends directly from amended Claim 1. Neither Sadwick et al. nor Zimmerman appears to disclose "a grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the anode", as recited in currently amended Claim 1, added limitations underlined. Thus, Claim 20 is also believed to be nonobvious over the asserted combination of Sadwick et al. and Zimmerman for failing to meet the third prong of the test for obviousness stated above. Applicants respectfully request reconsideration of the obviousness rejection of Claim 20 for these reasons.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 5,850,120 to Okamoto

Claims 21-28 and 30-37 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Okamoto.

Okamoto discloses an electron gun with a gamma correct field emission cathode. The field emission device of Okamoto may be configured with one or more gate layers that are used to pull electrons from the cathode and focus the electron beam onto an anode. The electron gun of Okamoto is provided with a cone-shaped cathode with a sharp-pointed tip to generate a field concentration which causes an electron emission from the top of the cathode. [Col. 1, Lines 11-14.] The gate structure of Okamoto is specifically designed with an annular or circular opening to minimize electron transit time and prevent beam spreading. Such gate features of the Okamoto device are not required for the thermionic emission device grids of the present invention. Furthermore, Okamoto does not disclose grids suitable for thermionic emission devices which are fundamentally incompatible with field emission devices and structures.

Applicants have amended Claims 21-25, 27-28, 30-34 and 36-37 to more accurately define the structure of the first, second and third grids and the geometry of their respective apertures. Specifically, all instances of the word "grid" in amended Claims 21-25, 27-28, 30-34 and 36-37 have been amended to recite "elongated grid". Support for this amendment is clearly shown in FIG. 1 and paragraph [0047]. Additionally, Applicants have amended Claims 21, 30 and 44, to further define the environment of the invention as recited in the preamble. More specifically, the preamble of currently amended Claims 21, 30 and 44 now recite "A thermionic emission device", added limitation underlined.

Applicants have also amended Claim 21 to recite "a first elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the second member, the first elongated grid forming a first at least one aperture configured for allowing passage of electrons therethrough", added limitations underlined.

Okamoto does not disclose "a first elongated grid supported by at least one elongated wall-shaped support extending perpendicularly from the substrate, the wall-shaped support configured to be free standing and not supporting the second member, the first elongated grid forming a first at least one aperture configured for allowing passage of electrons therethrough", added limitations underlined. Similarly, Okamoto does not disclose second or third elongated grids supported on elongated supports. Rather, Okamoto discloses field emission cathodes with grids having multiple layers for electron beam focusing. FIG. 9 of Okamoto appears to illustrate a cross-section of a multiple grid structure extending perpendicularly from the substrate 39. However, because the cathodes 1, 34 disclosed in Okamoto are of the Spindt cone variety, the Okamoto grid structures do not comprise "elongated grids" having "elongated supports" as recited in amended Claim 21. Rather, the cone shaped cathodes 1, 34 of Okamoto are surrounded by "a circular-shaped opening portion which surrounds the cone-shaped cathode". Col. 6, Lines 7-23.

Regarding Claim 30, Applicants have further amended to recite the limitation “wherein the first, second and third elongated grids are supported by at least one elongated wall-shaped support extending perpendicularly from the substrate that is configured to be free standing and not supporting the second member”, added limitations underlined. As noted above, Okamoto does not disclose “elongated grids” having “elongated supports” as recited in amended Claim 30.

Applicants further assert that Sadwick et al. does not disclose elongated grid structures as recited in amended Claims 21-25, 27-28, 30-34 and 36-37. Rather, Sadwick et al. discloses an electrically conductive grid layer 28 supported between two *planar* resistive layers 20 and 34. Col. 3, Lines 37-48; FIGS. 1A, 1B, 2A and 2B. Thus, by amendment Sadwick et al. in view Okamoto fails the third prong of the test for a *prima facie* case of obviousness.

Furthermore, Applicants can find no motivation or suggestion to combine the field emission device taught by Okamoto with the thermionic emission device of Sadwick et al. to obtain the claimed inventions. Moreover, there would be no reasonable expectation of success to make the asserted combination, *i.e.*, combining the field emission device of Okamoto with the thermionic emission device taught by Sadwick et al. Thus, by amendment Sadwick et al. in view Okamoto also fails the first and second prongs of the test for a *prima facie* case of obviousness. Applicants respectfully request reconsideration of the obviousness rejection of Claims 21-28 and 30-37 for all these reasons.

Obviousness Rejection Based on U.S. Patent No. 5,841,219 to Sadwick et al. in view of U.S. Patent No. 5,850,120 to Okamoto in further view of U.S. Patent No. 5,397,957 to Zimmerman

Claims 29 and 38 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Sadwick et al. in view of Okamoto and further in view of Zimmerman. Claims 29 and 38 are now believed to be nonobvious over the asserted combination of Sadwick et al. in view of Okamoto and further in view of Zimmerman because of the amendments to the respective independent claims from which they depend. Applicants respectfully

request reconsideration of the obviousness rejection of Claims 29 and 38 for the same reasons.

CONCLUSION

Claims 1-3, 5-38 and 44-45 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 50-0881.

Respectfully Submitted,



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